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(54) **METHODS AND SYSTEMS FOR REDUCING SPILLOVER BY DETECTING SIGNAL DISTORTION**

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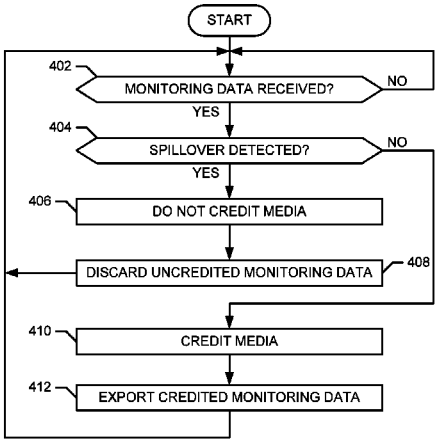
(57) **ABSTRACT**

Methods, apparatus, and articles of manufacture for reducing spillover in a media monitoring system are disclosed. An example method includes determining an actual frequency spectrum of the media monitored by a meter, and determining absolute values of differences between amplitudes of corresponding frequency components of the actual frequency spectrum and an expected frequency spectrum, the expected frequency spectrum stored in a database in association with a media identifier corresponding to the media. An example method also includes determining whether spillover occurred based on a summation of the absolute values satisfying a threshold, crediting the media with a media exposure if spillover did not occur.

20 Claims, 8 Drawing Sheets



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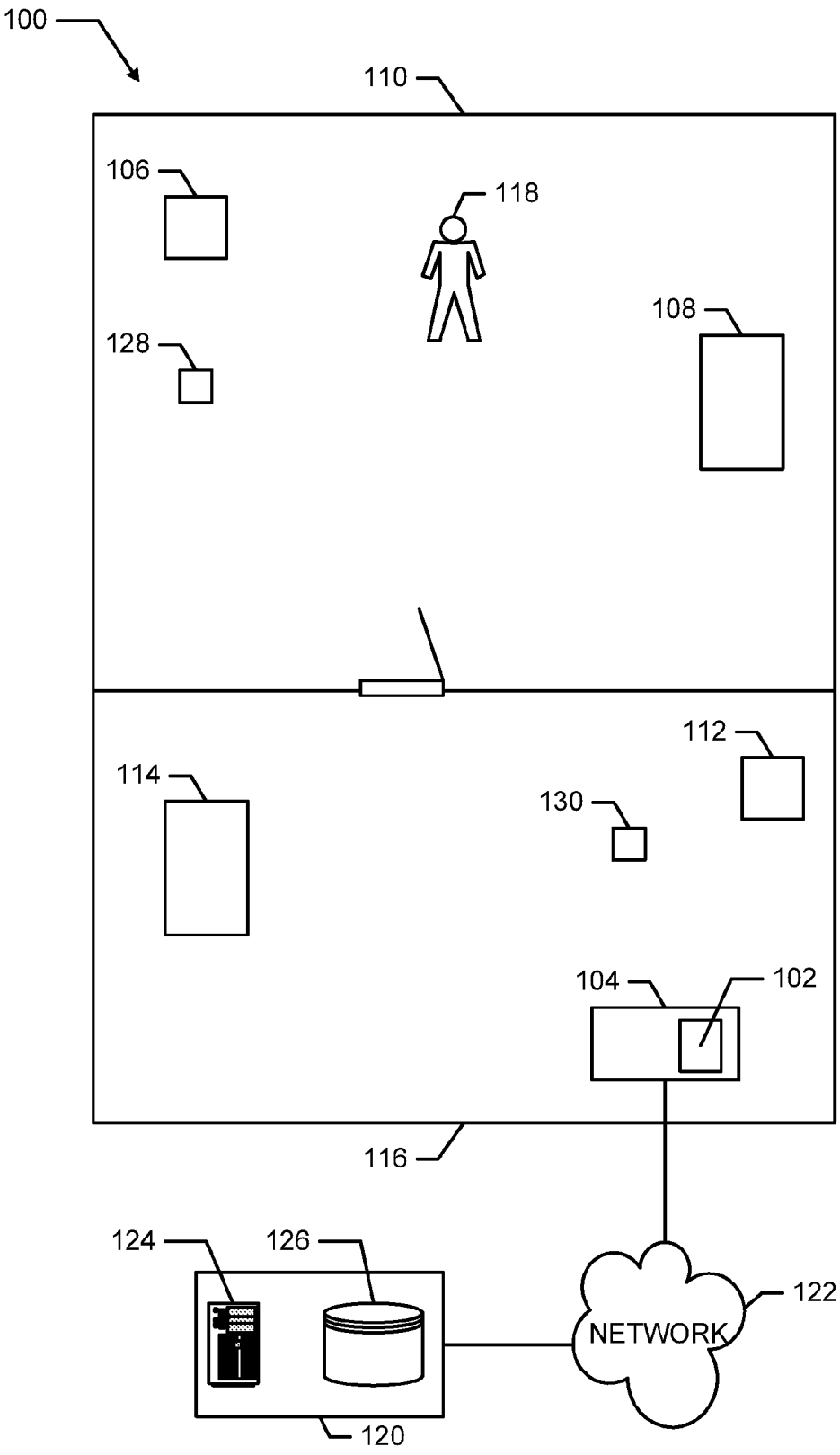
100
110
106
118
108
128
112
114
130
104
102
116
124
126
122
NETWORK
120

FIG. 1

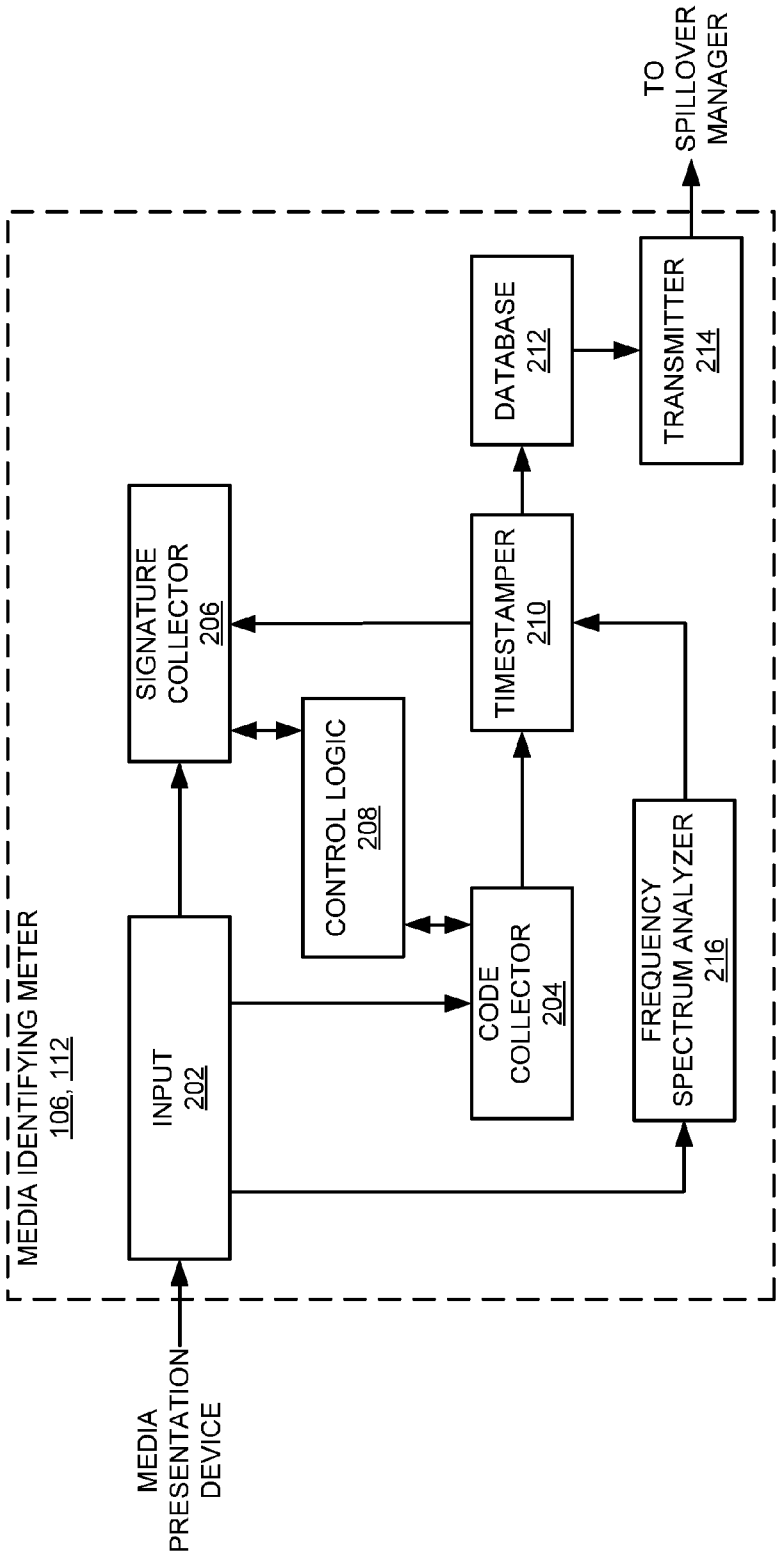
MEDIA PRESENTATION DEVICE
MEDIA IDENTIFYING METER 106, 112
INPUT 202
SIGNATURE COLLECTOR 206
CONTROL LOGIC 208
CODE COLLECTOR 204
TIMESTAMPER 210
FREQUENCY SPECTRUM ANALYZER 216
DATABASE 212
TRANSMITTER 214
TO SPILLOVER MANAGER

FIG. 2

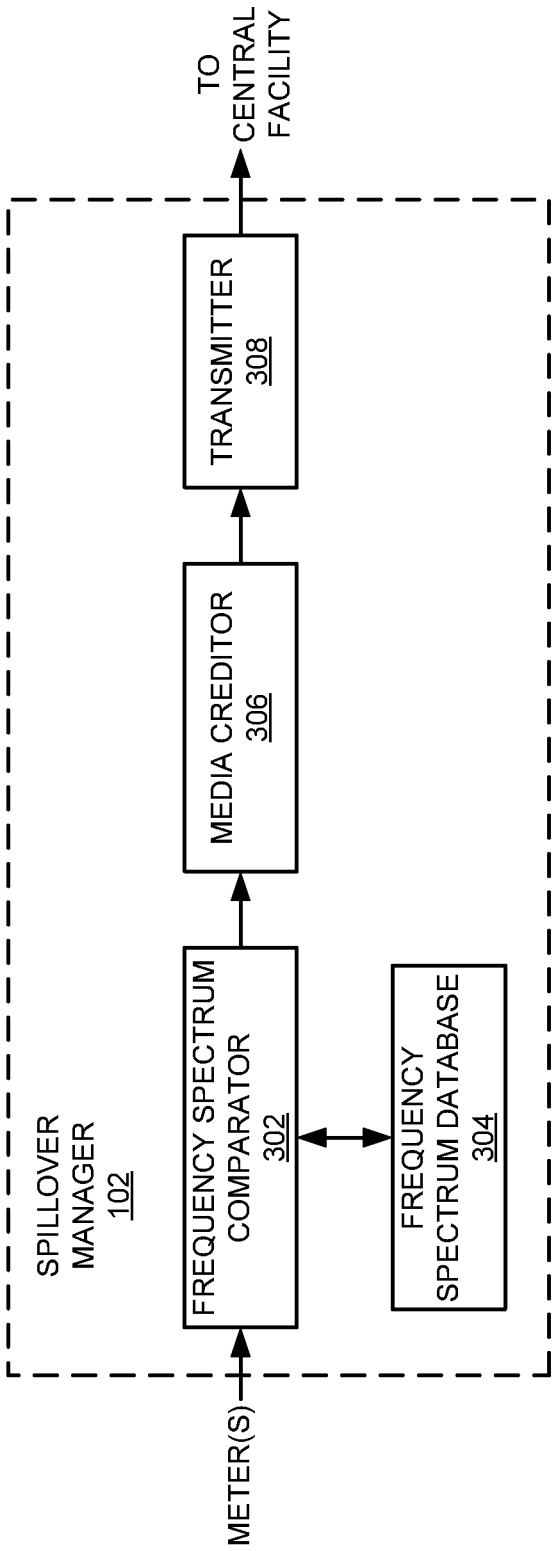
TO CENTRAL FACILITY
TRANSMITTER 308
MEDIA CREDITOR 306
FREQUENCY SPECTRUM COMPARATOR 302
FREQUENCY SPECTRUM DATABASE 304
SPILLOVER MANAGER 102
METER(S)

FIG. 3A

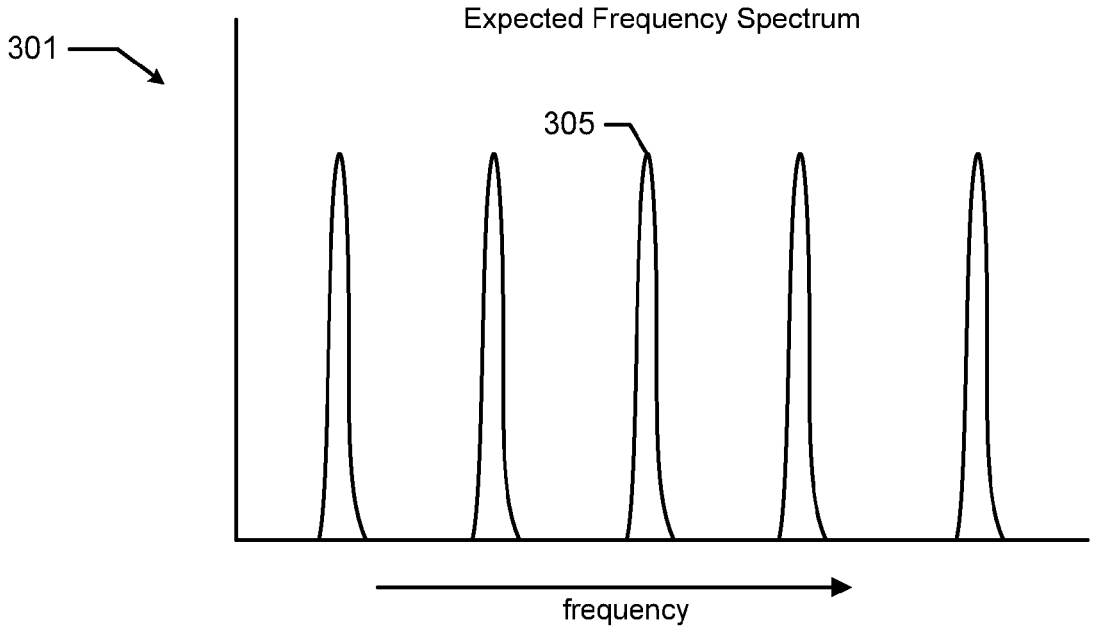
301
Expected Frequency Spectrum
305
frequency

FIG. 3B

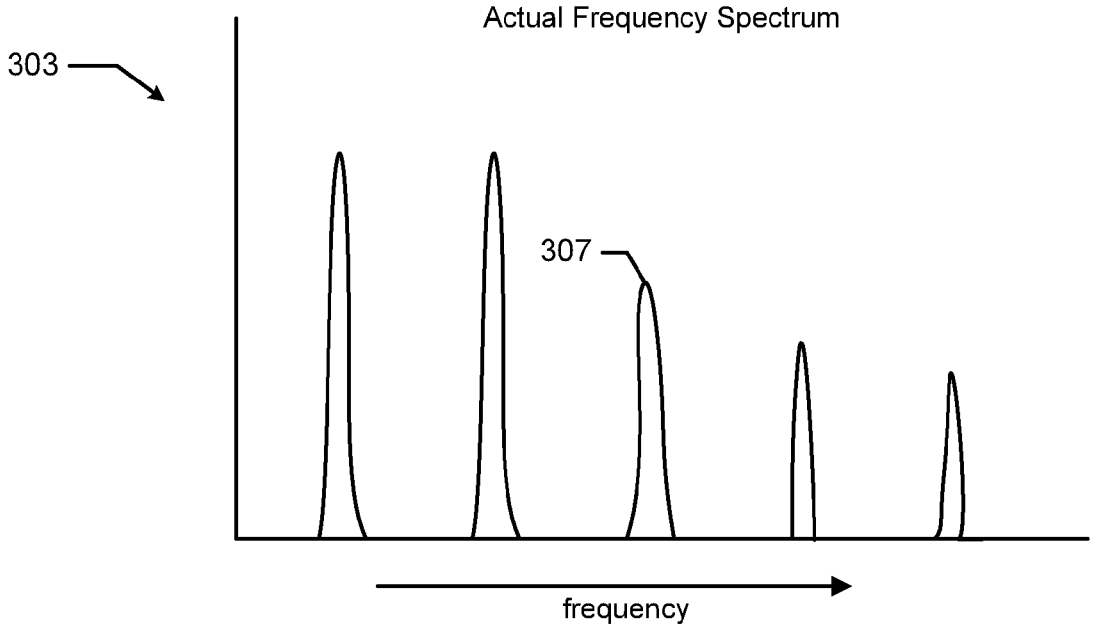
303
Actual Frequency Spectrum
307
frequency

FIG. 3C

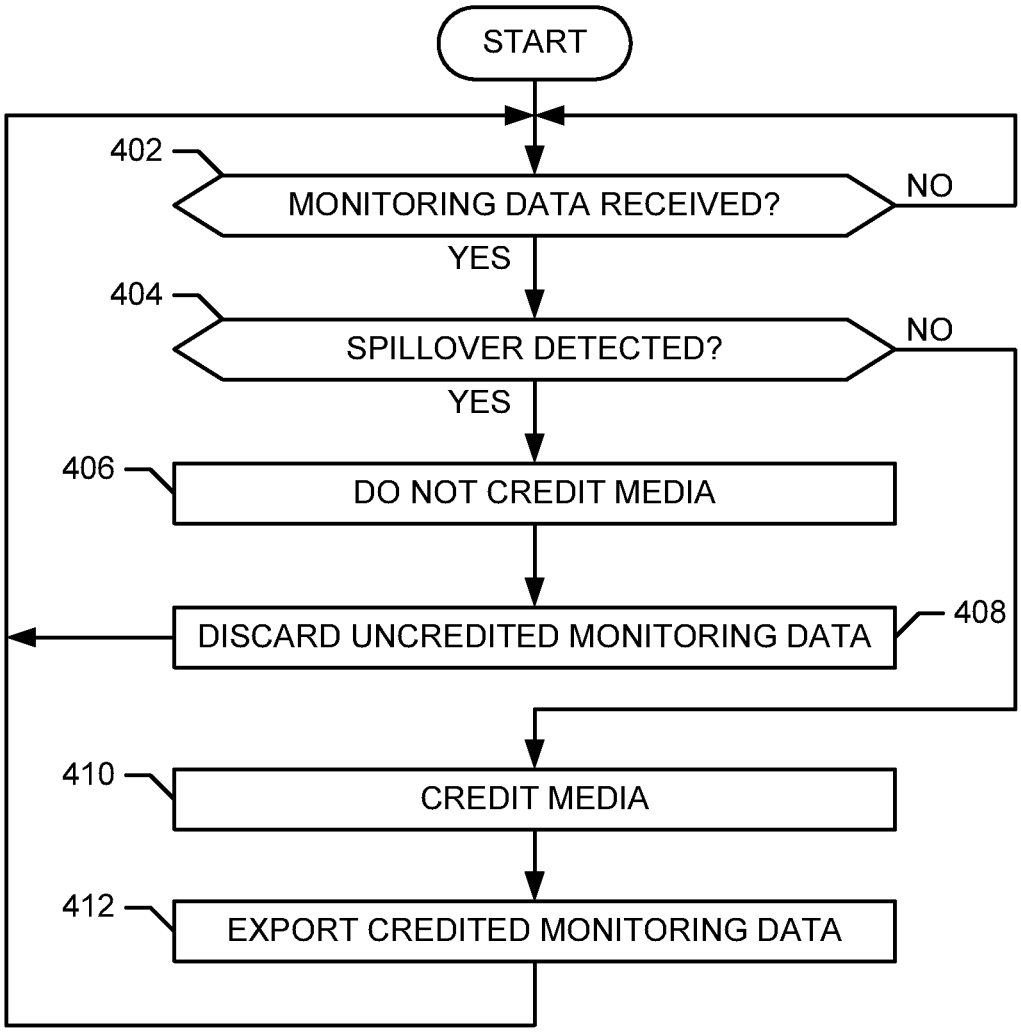
START
402
MONITORING DATA RECEIVED?
NO
YES
404
SPILLOVER DETECTED?
NO
YES
406
DO NOT CREDIT MEDIA
DISCARD UNCREDITED MONITORING DATA
408
410
CREDIT MEDIA
412
EXPORT CREDITED MONITORING DATA

FIG. 4

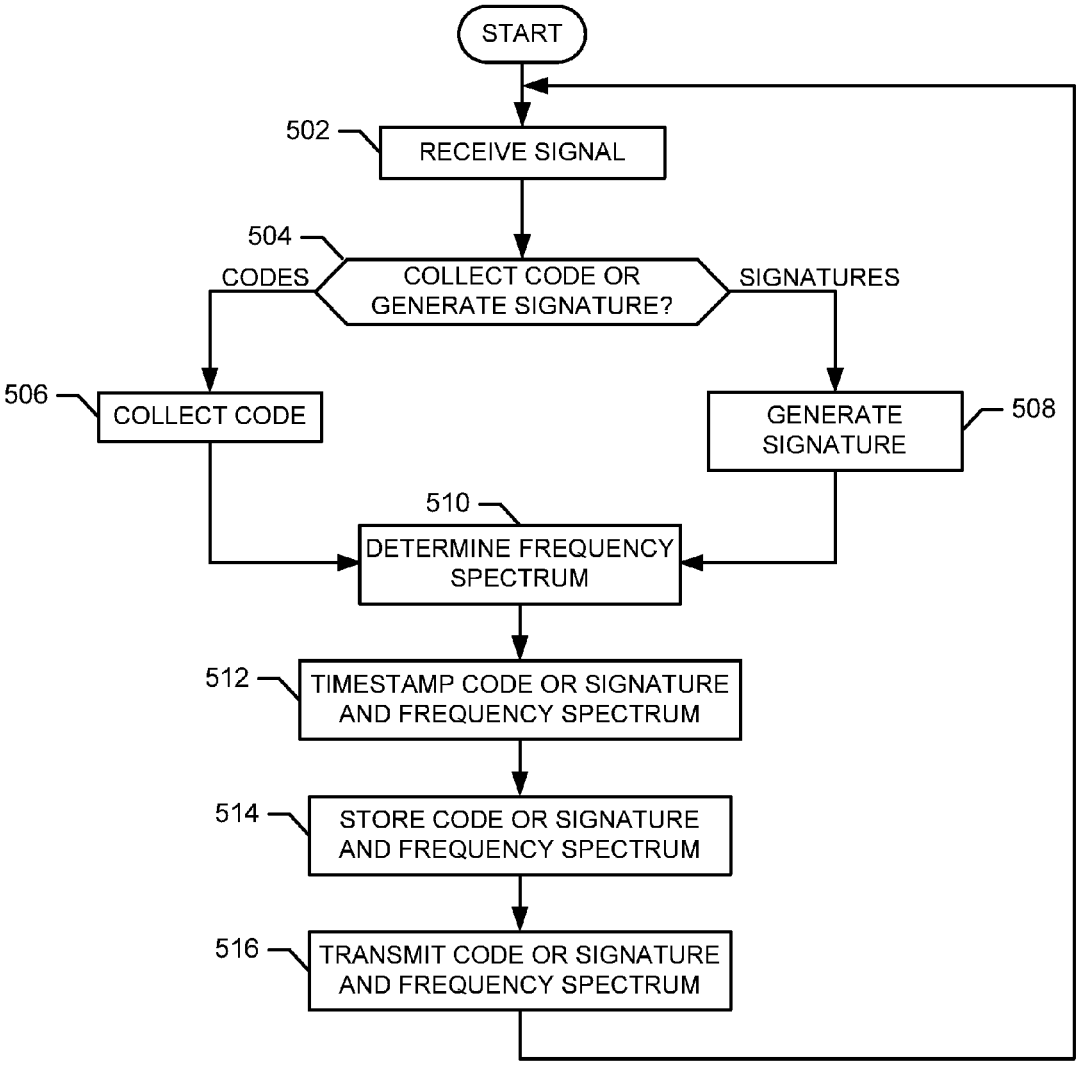
START
502
RECEIVE SIGNAL
504
CODES
COLLECT CODE OR GENERATE SIGNATURE?
SIGNATURES
506
COLLECT CODE
GENERATE SIGNATURE
508
510
DETERMINE FREQUENCY SPECTRUM
512
TIMESTAMP CODE OR SIGNATURE AND FREQUENCY SPECTRUM
514
STORE CODE OR SIGNATURE AND FREQUENCY SPECTRUM
516
TRANSMIT CODE OR SIGNATURE AND FREQUENCY SPECTRUM

FIG. 5

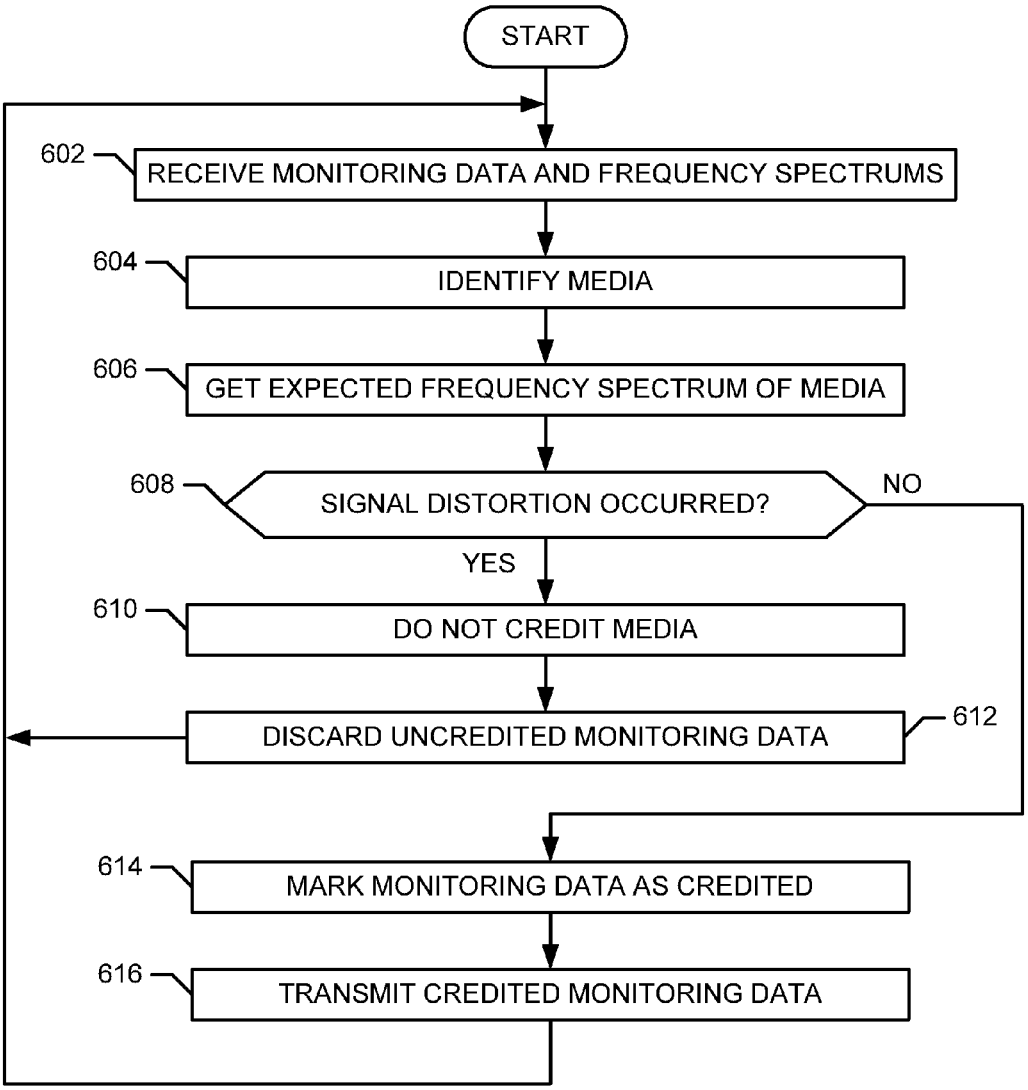
START
602
RECEIVE MONITORING DATA AND FREQUENCY SPECTRUMS
604
IDENTIFY MEDIA
606
GET EXPECTED FREQUENCY SPECTRUM OF MEDIA
608
SIGNAL DISTORTION OCCURRED?
NO
YES
610
DO NOT CREDIT MEDIA
612
DISCARD UNCREDITED MONITORING DATA
614
MARK MONITORING DATA AS CREDITED
616
TRANSMIT CREDITED MONITORING DATA

FIG. 6

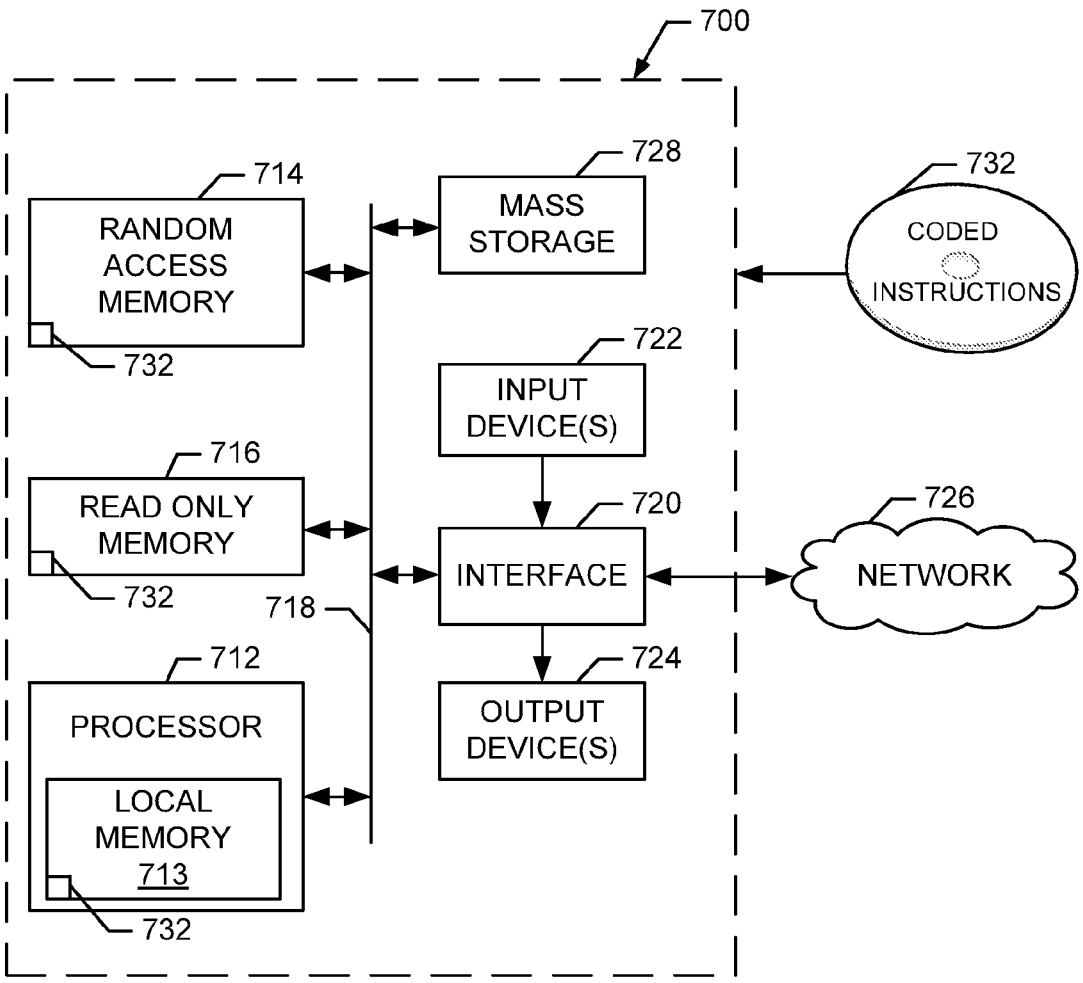
700
714
RANDOM ACCESS MEMORY
732
728
MASS STORAGE
732
CODED INSTRUCTIONS
722
INPUT DEVICE(S)
716
READ ONLY MEMORY
732
720
INTERFACE
726
NETWORK
718
712
PROCESSOR
LOCAL MEMORY 713
732
724
OUTPUT DEVICE(S)

FIG. 7

METHODS AND SYSTEMS FOR REDUCING SPILLOVER BY DETECTING SIGNAL DISTORTION

RELATED APPLICATIONS

This patent arises from a continuation of U.S. application Ser. No. 13/791,432, filed Mar. 8, 2013, which is hereby incorporated by reference in its entirety.

FIELD OF THE DISCLOSURE

The present disclosure relates generally to media monitoring and, more particularly, to methods and systems for reducing spillover by detecting signal distortion.

BACKGROUND

Audience measurement of media, such as television, music, movies, radio, Internet websites, streaming media, etc., is typically carried out by monitoring media exposure of panelists that are statistically selected to represent particular demographic groups. Using various statistical methods, the captured media exposure data is processed to determine the size and demographic composition of the audience(s) for programs of interest. The audience size and demographic information is valuable to advertisers, broadcasters and/or other entities. For example, audience size and demographic information is a factor in the placement of advertisements, as well as a factor in valuing commercial time slots during a particular program.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an example system including an example spillover manager implemented in accordance with the teachings of this disclosure to manage spillover to reduce media monitoring inaccuracies in the system.

FIG. **2** illustrates an example implementation of an example media identifying meter of FIG. **1**.

FIG. **3**A illustrates an example implementation of the example spillover manager of FIG. **1**.

FIG. **3**B illustrates an example expected frequency spectrum analyzed by the example spillover manager of FIG. **3**A.

FIG. **3**C illustrates an example actual frequency spectrum analyzed by the example spillover manager of FIG. **3**A.

FIG. **4** is a flow diagram representative of example machine readable instructions that may be executed to implement the example spillover manager of FIGS. **1** and/or **3**.

FIG. **5** is a flow diagram representative of example machine readable instructions that may be executed to implement the example media identifying meter of FIGS. **1** and/or **2**.

FIG. **6** is another flow diagram representative of example machine readable instructions that may be executed to implement the example spillover manager of FIGS. **1** and/or **3**.

FIG. **7** is a block diagram of an example processor platform that may be used to execute the instructions of FIGS. **4**, **5**, and/or **6** to implement the example media identifying meter **106** of FIG. **2**, the example spillover manager of FIG. **3**A, and/or, more generally, the example system of FIG. **1**.

DETAILED DESCRIPTION

Audience measurement companies enlist persons to participate in measurement panels. Such persons (e.g., panelists) agree to allow the audience measurement company to measure their exposure to media (e.g., television programming, radio programming, Internet, advertising, signage, outdoor advertising, etc.). In order to associate media monitoring data (i.e., data reflecting media presentation) with panelist demographics, the audience measurement company monitors media device(s) and/or panelist(s) using meters.

In some examples, meters (e.g., stationary meters) are placed with and/or near media presentation devices (e.g., televisions, stereos, speakers, computers, etc.) within a home or household. For example, a meter may be placed in a room with a television and another meter may be placed in a different room with another television. In some examples, personal portable metering devices (PPMs), which are also known as portable metering devices or portable personal (or people) meters, are used to monitor media exposure of panelists. A PPM is an electronic device that is typically worn (e.g., clipped to a belt or other apparel) or carried by a panelist. The term "meter" as used herein refers generally to stationary meters and/or portable meters.

In general, media identifying meters are configured to use a variety of techniques to monitor media presentations at media presentation devices and/or exposure of panelists to media presentations. For example, one technique for monitoring media exposure involves detecting or collecting media identifying information (e.g., codes (e.g., watermarks), signatures, etc.) from media signals (e.g., audio and/or video signals) that are emitted or presented by media presentation devices.

As media (e.g., content and/or advertisements) is presented, a media identifying meter may receive media signals (e.g., via a microphone) associated with the media and may detect media (e.g., audio and/or video) information associated with the media to generate media monitoring data. In general, media monitoring data may include any information that is representative of (or associated with) media and/or that may be used to identify a particular media presentation (e.g., a song, a television program, a movie, a video game, an advertisement, etc.). For example, the media monitoring data may include signatures that are collected or generated by the media identifying meter based on the media, audio codes that are broadcast simultaneously with (e.g., embedded in) the media, etc. Each media identifying meter may receive different media signals based on the media presented (e.g., tuned) on the media presentation devices to which panelists are exposed.

Media monitoring systems may also include one or more people meters to identify panelists in a monitored audience. Identifying the panelists in the audience allows mapping of their demographics to the media. Panelists provide their demographic information when they agree to be monitored by the audience measurement system. Any method of people metering may be employed. For example, the people metering may be active in that it requires panelists to self-identify by, for instance, entering an identifier corresponding to their name, or it may be passive in that electronics (e.g., video cameras) may be used to identify and/or count persons in the audience. See U.S. Pat. No. 7,609,853, which is hereby incorporated by reference herein in its entirety for an example people metering solution.

A panelist home may present unique monitoring challenges to the media identifying meters. For example, a panelist home often includes multiple media presentation devices, each configured to present media to specific viewing and/or listening areas located within the home. Known media identifying meters that are located in one of the viewing and/or listening areas are typically configured to detect any media being presented in the viewing and/or listening area

and to credit the media as having been presented. Thus, known media identifying meters operate on the premise that any media detected by the media identifying meter is media that was presented in that particular viewing and/or listening area. However, in some cases, a media identifying meter may detect media that is emitted by a media presentation device that is not located within the viewing or listening proximity of a panelist in the room with the media identifying meter thereby causing the detected media to be improperly credited to the panelist currently associated with the monitored area (via, for example, a people meter). The ability of the media identifying meter to detect media being presented outside of the viewing and/or listening proximity of the panelist is referred to as "spillover" because the media being presented outside of the viewing and/or listening proximity of the panelist is "spilling over" into the area occupied by the media identifying meter and may not actually fall within the attention of the panelist. Spillover may occur, for example, when a television in a particular room is powered off, but a media identifying meter associated with that television detects media being presented on a media presentation device in a different room of the panelist home or of an adjacent home (e.g., a neighbor's condominium or apartment). In such an example, the media identifying meter improperly credits the media as being presented on the media presentation device it monitors even though no such presentation occurred.

Another effect, referred to as "hijacking," occurs when a media identifying meter detects different media being presented at multiple media presentation devices at the same time. For example, a media identifying meter in a kitchen may detect a particular media program being presented on a media presentation device in the kitchen, but the media identifying meter may also detect a different media program that is being presented on a different media presentation device in a living room. In such an example, the media presented by the media presentation device in the living room may, in some cases, have signals that overpower or "hijack" the signals associated with the media being presented by the media presentation device in the kitchen. As a result, the media identifying meter in the kitchen may inaccurately credit the media being presented in the living room and fail to credit the media being presented in the kitchen. In some examples, other difficulties such as varying volume levels, varying audio/video content type (e.g., sparse, medium, rich, etc.), varying household transmission characteristics due to open/closed doors, movement and/or placement of furniture, acoustic characteristics of room layouts, wall construction, floor coverings, ceiling heights, etc. may exacerbate these issues and, thus, lead to inaccurate media presentation detection by media identifying meters.

Example methods and systems disclosed herein may be used to manage audio spillover and/or other sources of media monitoring inaccuracies in the course of presentations of media to more accurately assess the exposure of panelists to that media. Example methods and systems may be used to prevent audio spillover from adversely affecting results of media monitoring. Some example methods and systems analyze media monitoring data to determine if audio spillover has occurred. In some such examples, if audio spillover has not occurred, the media is credited as actual media exposure (e.g., a panelist has been exposed to the media). If audio spillover has occurred, the media is not credited as an actual media exposure.

Example methods and systems disclosed herein detect signal spillover by analyzing signal distortion associated with media presentations (e.g., signal distortion of audio signal waveforms representative of media presentations). Particular media presentations (e.g., signals representative of particular media content and/or advertisements) have particular frequency spectrums associated with them (e.g., a particular frequency spectrum may be expected from a particular media presentation). A frequency spectrum expected from a particular media presentation is referred to herein as an expected frequency spectrum. In some examples, a media identifying meter monitoring a media presentation from a proximate media presentation device may analyze a waveform of the media presentation and determine an actual frequency spectrum of the waveform. In some examples, the actual frequency spectrum and/or data representative thereof is compared to the expected frequency spectrum and/or data representative thereof to determine if spillover has occurred. For example, the actual frequency spectrum may be different from the expected frequency spectrum when the audio has traveled a larger distance than expected between the media identifying meter and the media presentation device it monitors, the audio has been transmitted through different rooms (e.g., the signal has bounced off of walls, traveled through a wall, a ceiling, or a floor, etc.), etc. If the actual frequency spectrum is similar to the expected frequency spectrum (e.g., the signal has not been distorted beyond a threshold representation of spillover), it is determined that spillover has not occurred. If the actual frequency spectrum is not similar to the expected frequency spectrum (e.g., the signal has been distorted beyond a threshold representation of spillover), it is determined that spillover has occurred. In some examples, when it is determined that spillover has occurred, the media presentation is not credited as an actual media exposure.

An example method disclosed herein includes identifying media based on media monitoring data. The media monitoring data is received from a first media identifying meter associated with a first media presentation device. The example method includes identifying an expected frequency spectrum associated with the media. The example method includes comparing the expected frequency spectrum to an actual frequency spectrum collected from the media by the first meter to determine if spillover occurred. The example method includes crediting the media as a media exposure if spillover did not occur.

An example spillover manager disclosed herein includes a frequency spectrum comparator to identify an expected frequency spectrum for media associated with media monitoring data received from a meter associated with a media presentation device. The example frequency spectrum comparator is to compare the expected frequency spectrum to an actual frequency spectrum to determine if spillover occurred. The actual frequency spectrum is based on a sample of the media collected by the meter. The example spillover manager includes a media creditor to credit the media with an exposure if spillover did not occur and to not credit the media with an exposure if spillover did occur.

An example tangible computer readable storage medium disclosed herein comprises instructions that, when executed, cause a computing device to identify media associated with media monitoring data. The media monitoring data is received from a first meter associated with a first media presentation device. The example instructions cause the computing device to identify an expected frequency spectrum associated with the media. The example instructions cause the computing device to compare the expected frequency spectrum to an actual frequency spectrum collected from the media by the first meter to determine if spillover occurred. The example instructions cause the computing device to credit the media as a media exposure if spillover did not occur.

FIG. **1** illustrates an example media monitoring system **100** in an example environment of use. The example of FIG. **1** includes an example spillover manager **102** implemented in accordance with the teachings of this disclosure to manage spillover to reduce (e.g., prevent) media monitoring inaccuracies in the media monitoring system **100**. In the illustrated example, a first media identifying meter **106** monitors media presented by a first media presentation device **108** in a first room **110** and a second media identifying meter **112** monitors media presented on a second media presentation device **114** in a second room **116**. Either or both of the first and second media presentation devices **108**, **114** may be, for example, a television, a radio, a computer, a stereo system, a DVD player, a game console, etc. Media may include, for example, any form of content, television programming, radio programming, movies, songs, any form of advertisements, Internet information such as websites and/or streaming media, and/or any other video information, audio information, still image information, and/or computer information to which a panelist (e.g., an example panelist **118**) may be exposed. While two rooms **110**, **116**, two media presentation devices **108**, **114**, and two media identifying meters **106**, **112** are shown in the example of FIG. **1**, any number and/or type(s) of rooms, any number and/or type(s) of media presentation devices, and/or any number and/or type(s) of meters (including, for example, people meters) in any configuration and/or spatial relationship may be implemented in the example system **100**.

In the illustrated example, to respectively monitor media presented on the first and second media presentation devices **108**, **114**, the first and second media identifying meters **106**, **112** process media signals (or portions thereof such as audio portions of the media signals) respectively output by the first and second media presentation devices **108**, **114** to extract codes and/or metadata, and/or to generate signatures for use in identifying the media and/or a station (e.g., a broadcaster) originating the media. The first media identifying meter **106** of the illustrated example is intended to monitor the first media presentation device **108** and to not monitor the second media presentation device **114**. The second media identifying meter **112** is intended to monitor the second media presentation device **114** and to not monitor the first media presentation device **108**.

Identification codes, such as watermarks, ancillary codes, etc. may be embedded within or otherwise transmitted with media signals. Identification codes are data that are inserted into media (e.g., audio or video) to uniquely identify broadcasters and/or media (e.g., content or advertisements), and/or are carried with the media for another purpose such as tuning (e.g., packet identifier headers ("PIDs") used for digital broadcasting). Codes are typically extracted using a decoding operation.

Signatures are a representation of one or more characteristic(s) of the media signal (e.g., a characteristic of the frequency spectrum of the signal). Signatures can be thought of as fingerprints. They are typically not dependent upon insertion of identification codes in the media, but instead preferably reflect an inherent characteristic of the media and/or the media signal. Systems to utilize codes and/or signatures for audience measurement are long known. See, for example, Thomas, U.S. Pat. No. 5,481,294, which is hereby incorporated by reference in its entirety. Codes, metadata, signatures, channel identifiers (e.g., tuned channel numbers), etc. collected and/or generated by the first or second media identifying meters **106**, **112** for use in identifying media and/or a station transmitting media may be referred to generally as "media monitoring data."

In the illustrated example, media monitoring data collected by the first media identifying meter **106** and/or the second media identifying meter **112** is transferred to the home processing system **104** for further processing. The first and second media identifying meters **106**, **112** may be communicatively coupled with the home processing system **104** via wireless and/or hardwired communications and may periodically and/or aperiodically communicate collected media monitoring information to the home processing system **104**. People meters **128**, **130** may likewise be communicatively coupled with the home processing system **104** to periodically and/or aperiodically forward people identification data to the home processing system **104**.

In the illustrated example, the home processing system **104** is communicatively coupled to a remotely located central data collection facility **120** via a network **122**. The example home processing system **104** of FIG. **1** transfers collected media monitoring data to the central facility **120** for further processing. The central facility **120** of the illustrated example collects and/or stores, for example, media monitoring data that is collected by multiple media monitoring devices such as, for example, the media identifying meters **106**, **112**, and/or demographic information that is collected by people meters, located at multiple panelist locations. The central facility **120** may be, for example, a facility associated with an audience measurement entity such as The Nielsen Company (US), LLC or any affiliate of The Nielsen Company (US), LLC. The central facility **120** of the illustrated example includes a server **124** and a database **126** that may be implemented using any suitable processor, memory and/or data storage apparatus such as that shown in FIG. **7**. In some examples, the home processing system **104** is located in the central facility **120**.

The network **122** of the illustrated example is used to communicate information and/or data between the example home processing system **104** and the central facility **120**. The network **122** may be implemented using any type(s) of public and/or private network(s) such as, but not limited to, the Internet, a telephone network, a cellular network, a local area network ("LAN"), a cable network, and/or a wireless network. To enable communication via the network **122**, the home processing system **104** of the illustrated example includes a communication interface that enables connection to an Ethernet, a digital subscriber line ("DSL"), a telephone line, a coaxial cable, and/or any wireless connection, etc.

Some known methods for measuring media exposure or presentation track or log media presentations to which a panelist is exposed and award a media exposure credit to a media presentation whenever the panelist is in the vicinity of that media presentation. However, some such methods may produce inconsistent or inaccurate monitoring results due to spillover that occurs. For example, within the example environment illustrated in FIG. **1**, spillover may occur when the first media presentation device **108** is powered off (e.g., is not presenting media), but the first media identifying meter **106** associated with the first media presentation device **108** detects media being presented by the second media presentation device **114**. In such an example, the first media identifying meter **106** will incorrectly credit the media presented at the second media presentation device **114** as being presented to the panelist **118**. Recording media data that has spilled over from another space (e.g., the room **116**) may result in an inaccurate representation of the media presented to the panelist **118**. In some such examples, the panelist **118** may not even know or be aware of the media, but the electronics of the media identifying meter **106** may still be sensitive enough to detect a code in the media presented by the second media presentation device **114**.

The spillover manager **102** of the illustrated example is used to manage spillover to reduce (e.g., prevent) media monitoring inaccuracies in the example system **100** of FIG. **1**. The example spillover manager **102** of FIG. **1** receives media monitoring data from the first example media identifying meter **106** and/or the second example media identifying meter **112** and analyzes the media monitoring data to determine if spillover has occurred. In the illustrated example, if the example spillover manager **102** detects spillover associated with the first media identifying meter **106** and/or the second media identifying meter **112**, the media identified in the media monitoring data is not credited as actual media exposure for the meter/monitored media presentation device that experienced the spillover and the media monitoring data associated with the uncredited media is discarded and/or marked as invalid. In the illustrated example, if the example spillover manager **102** does not detect spillover associated with the first media identifying meter **106** and/or the second media identifying meter **112**, the media identified in the media monitoring data is credited as actual media exposure(s). In the illustrated example, the spillover manager **102** sends media monitoring data associated with credited media to the example central facility **120**. In some examples, the spillover manager **102** labels portion(s) of the media monitoring data as either associated with credited or uncredited media and sends the identified media monitoring data to the example central facility **120**.

In the illustrated example, the spillover manager **102** detects spillover by detecting signal distortion associated with media presentations. The spillover manager **102** of the illustrated example detects signal distortion by analyzing frequency spectrums associated with media presentations (e.g., frequency spectrums of audio signal waveforms representative of media presentations). A frequency spectrum is a representation of an audio signal in the frequency domain. Particular media presentations (e.g., particular content and/or advertisements) have particular expected frequency spectrums associated with them (e.g., a particular frequency spectrum may be expected from a particular media presentation when the media is received in the same room in which the media presentation device resides). A frequency spectrum expected from a particular media presentation may be referred to as an expected frequency spectrum. The spillover manager **102** of the illustrated example stores and/or accesses (e.g., from the central facility **120**) expected frequency spectrums and/or data representative thereof for use in spillover detection. Expected frequency spectrums may be determined during, for example, a training period where frequency spectrums for particular media presentations are gathered and analyzed for use in spillover detection. Alternatively, expected frequency spectrums may be collected by the entity associated with the central facility and stored in association with an identifier of the media (e.g., a code or a signature) to enable lookup of the same. In some examples, an expected frequency spectrum serves as a signature of the corresponding media.

In the illustrated example, the first and second media identifying meters **106**, **112** receive media signals (e.g., audio) associated with media presentations (e.g., via microphones). In the illustrated example, in addition to collecting media monitoring data from the received media signals, the example first and second media identifying meters **106**, **112** analyze audio waveforms of the media signals and determine or calculate frequency spectrums of the audio waveforms. The frequency spectrums and/or data representative thereof (e.g., frequency spectrum data) calculated by the example first and second media identifying meters **106**, **112** are referred to as "actual frequency spectrums" because they represent the frequency spectrums of the audio waveforms after they have been presented on the first or second media presentation devices **108**, **114** and received at the corresponding first and second media identifying meters **106**, **112**. The first and second media identifying meters **106**, **112** of the illustrated example timestamp the media monitoring data and the actual frequency spectrum data and send the timestamped media monitoring data and actual frequency spectrum data to the example spillover manager **102** for analysis. In some examples, the frequency spectrum data is not generated at the media identifying meters **106**, **112**, but instead is generated at the spillover manager **102**.

The spillover manager **102** of the illustrated example uses the media monitoring data to identify the media presented at the first and/or second media presentation device **108**, **114**. Once the media is identified, the spillover manager **102** of the illustrated example finds the expected frequency spectrum for that media (e.g., by using an identifier of the identified media to access a table storing the expected frequency spectrums). To determine if spillover occurred, the spillover manager **102** of the illustrated example compares the expected frequency spectrum (or data representative thereof) for the identified media to the actual frequency spectrum (or data representative thereof) generated based on the data collected by the example first and/or second media identifying meter **106**, **112**. If the actual frequency spectrum is sufficiently similar to the expected frequency spectrum (e.g., the signal was not distorted), the example spillover manager **102** determines that spillover did not occur for the corresponding media identification event. Thus, the person(s) (e.g., the panelist **118**) identified as present by a first people meter **128** associated with the corresponding media identifying meter that collected the data (e.g., the first media identifying meter **106**/first media presentation device **108** or a second people meter **130** associated with the second media identifying meter **112**/second media presentation device **114**) are credited as having been exposed to the media. If the actual frequency spectrum is not sufficiently similar to the expected frequency spectrum (e.g., the signal was distorted), the example spillover manager **102** determines that spillover occurred for the corresponding media identification event. Thus, the persons (e.g., the panelist **118**) identified as present by the corresponding people meter (e.g., the first people meter **128** or the second people meter **130**) are not credited as having been exposed to the media. In other words, when the example spillover manager **102** of FIG. **1** determines that spillover has occurred, the media is not credited as actual media exposure at the corresponding media presentation device (e.g., media presentation devices **108**, **114**).

For example, when the first example media identifying meter **106** receives a media signal, it determines an actual frequency spectrum for the received media signal, in addition to collecting media monitoring data for the received media signal. In such an example, the first media identifying meter **106** sends the actual frequency spectrum and/or data representative thereof and the media monitoring data to the example spillover manager **102**. The example spillover manager **102** identifies the media (e.g., content or advertisement) from the media monitoring data and accesses (e.g., looks up in a local database or cache, retrieves from a remote database such as a database at the central facility **120**) an expected frequency spectrum associated with that media (i.e., the media identified by the media monitoring data). If the actual frequency spectrum is similar to the expected frequency spectrum, the example spillover manager **102** assumes the media was presented on the first example media presentation device

108 corresponding to the first media identifying meter 106 (i.e., the media identifying meter that provided the media monitoring data under analysis) and credits the media as an actual media exposure at the corresponding media presentation device. Thus, the person(s) identified as present by the first people meter 128 (e.g., the panelist 118) are credited as having been exposed to the media. If the actual frequency spectrum is not similar to the expected frequency spectrum, the example spillover manager 102 assumes the media was not presented on the example media presentation device 108 (e.g., the media was presented on the media presentation device 114 and the media signal spilled over to the example media identifying meter 106), and does not credit the media as an actual media exposure (e.g., does not credit the media with exposure to the panelist 118).

While the spillover manager 102 of the illustrated example is shown within the example home processing system 104, the spillover manager 102 may be implemented at the first media identifying meter 106, the second media identifying meter 112, and/or at the central facility 120.

FIG. 2 is a block diagram of an example implementation of the first and/or second media identifying meters 106, 112 of FIG. 1. The media identifying meter 106, 112 of the illustrated example receives media signals (e.g., audio signals) from one or more media presentation devices (e.g., the first or second media presentation device 108, 114 of FIG. 1). In the illustrated example, the media identifying meter 106, 112 is used to collect media monitoring data (e.g., to extract and/or analyze codes and/or signatures from media signals output by a corresponding media presentation device 108, 114) and is used to determine frequency spectrums of the media signals. Thus, the media identifying meter 106, 112 of the illustrated example is used to collect, aggregate, locally process, and/or transfer media monitoring data and/or frequency spectrum data (e.g., data representative of determined frequency spectrums) to the spillover manager 102 of FIG. 1. The media identifying meter 106, 112 of the illustrated example includes an example input 202, an example code collector 204, an example signature generator 206, example control logic 208, an example timestamper 210, an example database 212, an example transmitter 214, and an example frequency spectrum analyzer 216.

In the illustrated example, the input 202 is a microphone exposed to ambient sound and serves to collect audio signals output by monitored media presentation devices (e.g., the media presentation device 108). To collect media monitoring data associated with the audio signals, the input 202 of the illustrated example passes a received audio signal to the code collector 204 and/or the signature generator 206. The code collector 204 of the illustrated example extracts codes and/or the signature generator 206 generates signatures from the signal to identify broadcasters, channels, stations, and/or programs. The control logic 208 of the illustrated example is used to control the code collector 204 and/or the signature generator 206 to cause collection of a code, a signature, or both a code and a signature. The identified codes and/or signatures (e.g., the media monitoring data) are timestamped at the example timestamper 210, are stored in the example database 212, and are transmitted by the example transmitter 214 to the spillover manager 102 at the home processing system 104. Although the example of FIG. 2 collects codes and/or signatures from audio signals, codes or signatures can additionally or alternatively be collected from other portion(s) of the signal (e.g., from the video portion).

The input 202 of the illustrated example also passes the received audio signal to the example frequency spectrum analyzer 216. The frequency spectrum analyzer 216 of the illustrated example analyzes the received audio signal and determines a frequency spectrum of the received audio signal. A frequency spectrum is a representation of the received audio signal in the frequency domain. The example input 202 may collect an audio signal for a period of time (e.g., ten seconds, one minute, five minutes, ten minutes, etc.) to enable the example frequency spectrum analyzer 216 to analyze the received audio signal and determine the frequency spectrum of the received audio signals. In some examples, the frequency spectrum analyzer 216 detects events (e.g., percussive events) that may be represented in the audio signals collected via the example input 202. For example, events that are unrelated to media presentations (e.g., dogs barking, doors slamming, etc.) may be picked up by the example input 202 and the frequency spectrum analyzer 216 may detect such events in the audio signals and remove representations of such events from the audio signals prior to and/or during determination of the frequency spectrums of the audio signals.

The frequency spectrum determined by the example frequency spectrum analyzer 216 is referred to as the actual frequency spectrum. The actual frequency spectrum and/or data representative thereof is timestamped at the example timestamper 210, stored at the example database 212, and transmitted by the example transmitter 214 to the example spillover manager 102 with the media monitoring data.

While an example manner of implementing the media identifying meter 106, 112 of FIG. 1 is illustrated in FIG. 2, one or more of the elements, processes and/or devices illustrated in FIG. 2 may be combined, divided, re-arranged, omitted, eliminated and/or implemented in any other way. Further, the example input 202, the example code collector 204, the example signature collector 206, the example control logic 208, the example timestamper 210, the example database 212, the example transmitter 214, the example frequency spectrum analyzer 216, and/or, more generally, the example media identifying meter 106, 112 of FIG. 1 may be implemented by hardware, software, firmware and/or any combination of hardware, software and/or firmware. Thus, for example, any of the example input 202, the example code collector 204, the example signature collector 206, the example control logic 208, the example timestamper 210, the example database 212, the example transmitter 214, the example frequency spectrum analyzer 216, and/or, more generally, the example media identifying meter 106, 112 could be implemented by one or more circuit(s), programmable processor(s), application specific integrated circuit(s) (ASIC(s)), programmable logic device(s) (PLD(s)) and/or field programmable logic device(s) (FPLD(s)), etc. When reading any of the apparatus or system claims of this patent to cover a purely software and/or firmware implementation, at least one of the example input 202, the example code collector 204, the example signature collector 206, the example control logic 208, the example timestamper 210, the example database 212, the example transmitter 214, the example frequency spectrum analyzer 216, and/or the example media identifying meter 106, 112 are hereby expressly defined to include a tangible computer readable storage device or storage disc such as a memory, DVD, CD, Blu-ray, etc. storing the software and/or firmware. Further still, the example media identifying meter 106, 112 of FIG. 1 may include one or more elements, processes and/or devices in addition to, or instead of, those illustrated in FIG. 2, and/or may include more than one of any or all of the illustrated elements, processes and devices.

FIG. 3A is a block diagram of an example implementation of the spillover manager 102 of FIG. 1. The spillover manager 102 of the illustrated example receives media monitoring data

and actual frequency spectrums (and/or data representative thereof) corresponding to the actual frequency spectrum from one or more media identifying meter(s) (e.g., the media identifying meters **106**, **112** of FIG. **1**). In the illustrated example, the spillover manager **102** uses the media monitoring data and the actual frequency spectrum data to determine whether spillover occurred (e.g., in the example system **100** of FIG. **1**) and whether identified media programs are to be credited with actual exposure to a panelist. The spillover manager **102** of the illustrated example is used to transfer credited media monitoring data (e.g., media monitoring data associated with credited media programs) to the central facility **120** of FIG. **1**. The spillover manager **102** of the illustrated example includes an example frequency spectrum comparator **302**, an example frequency spectrum database **304**, an example media creditor **306**, and an example transmitter **308**.

The frequency spectrum comparator **302** of the illustrated example receives media monitoring data and actual frequency spectrum data from the media identifying meter(s) (e.g., the first and second media identifying meters **106**, **112** of FIG. **1**). The frequency spectrum comparator **302** of the illustrated example uses the example frequency spectrum database **304** to identify media (e.g., media that was presented by the first or second media presentation device **108**, **114**) based on the media monitoring data and to identify an expected frequency spectrum associated with the identified media. Particular media programs are identified in the example frequency spectrum database **304** using the media monitoring data (e.g., using codes and/or signatures associated with the media). The frequency spectrum database **304** of the illustrated example stores media identifiers (e.g., identifiers of different media programs) along with expected frequency spectrums and/or data representative thereof associated with the media. For example, for each particular media program, the example frequency spectrum database **304** stores an expected frequency spectrum. Expected frequency spectrums may be calculated and/or determined at, for example, a central facility (e.g., the central facility **120** of FIG. **1**) prior to implementation of the example spillover manager **102** in the example system **100** of FIG. **1** and/or the spillover manager **102** may be implemented at the central facility **120** to process data collected from various meters. Additionally or alternatively, the frequency spectrum database **304** may be located at the central facility and the spillover manager **102** may query the database **304** via the network **122**.

Once the frequency spectrum comparator **302** obtains the expected frequency spectrum associated with the media, the frequency spectrum comparator **302** of the illustrated example compares the expected frequency spectrum to the actual frequency spectrum (e.g., the actual frequency spectrum received from the media identifying meter(s) for the media under analysis). An example expected frequency spectrum **301** is illustrated in FIG. **3**B and a corresponding example actual frequency spectrum **303** is illustrated in FIG. **3**C. Both the expected frequency spectrum **301** and the actual frequency spectrum **303** of the illustrated examples are associated with the same particular media.

If the actual frequency spectrum is sufficiently similar to the expected frequency spectrum (e.g., if the signal was not distorted more than a predetermined amount), the frequency spectrum comparator **302** of the illustrated example determines spillover did not occur and instructs the example media creditor **306** to credit the media as an actual media exposure. If the actual frequency spectrum is not sufficiently similar to the expected frequency spectrum (e.g., if the signal was distorted beyond a predetermined amount), the frequency spectrum comparator **302** of the illustrated example determines that spillover did occur and instructs the example media creditor **306** to not credit the media as an actual media exposure.

In some examples, the frequency spectrum comparator **302** determines that the signal was distorted when the actual frequency spectrum was altered when compared with the expected frequency spectrum. In some examples, the frequency spectrum comparator **302** determines that the signal was distorted when the actual frequency spectrum (e.g., the actual frequency spectrum **303** of FIG. **3**C) does not include or includes fewer high frequency elements than the expected frequency spectrum (e.g., the expected frequency spectrum **301** of FIG. **3**B). In some examples, the frequency spectrum comparator **302** determines that the signal is distorted when the actual frequency spectrum does not include or includes fewer mid-frequency elements than the expected frequency spectrum.

In some examples, to determine if the actual frequency spectrum is sufficiently similar to the expected frequency spectrum to conclude spillover did not occur, the example frequency spectrum comparator **302** calculates a summation of the absolute values of the differences between amplitudes of corresponding frequency components of the actual frequency spectrum (e.g., amplitudes **307** of the frequency spectrum **303** of FIG. **3**C) and the expected frequency spectrum (e.g., amplitudes **305** of the frequency spectrum **301** of FIG. **3**B). In such an example, the example frequency spectrum comparator **302** compares the summation of the absolute values of the differences between the amplitudes to a threshold. If the summation of the absolute values of the differences between the amplitudes is larger than the threshold, the example frequency spectrum comparator **302** determines that the actual frequency spectrum is not sufficiently similar to the expected frequency spectrum for the signal to have originated in the same room as the meter that logged the media and, thus, that spillover did occur. If the summation of the absolute values of the differences between the amplitudes is not larger than the threshold, the example frequency spectrum comparator **302** determines that the actual frequency spectrum is sufficiently similar to the expected frequency spectrum to conclude the signal originated from the media presentation device in the same room as the meter that detected the media and, thus, that spillover did not occur. An example equation to compare a summation of the absolute values of the differences between amplitudes of corresponding frequency components of the actual frequency spectrum and the expected frequency spectrum to a threshold is illustrated below. In the illustrated equation, f_{N_A} represents a frequency component of the actual frequency spectrum, f_{N_E} is the corresponding frequency component of the expected frequency spectrum, and T is the threshold.

$$\sum_{0}^{N} |F_{N_A} - F_{N_E}| < T$$

The media creditor **306** of the illustrated example credits/does not credit media as actual media exposure based on the output of the example frequency spectrum comparator **302**. If the example frequency spectrum comparator **302** determines that spillover did not occur, the media creditor **306** of the illustrated example marks the media monitoring data associated with the media as credited. If the example frequency spectrum comparator **302** determines that spillover did occur,

the media creditor **306** of the illustrated example discards the media monitoring data associated with the media. In some examples, rather than discarding the media monitoring data associated with the media that is not credited, the example media creditor **306** marks the media monitoring data associated with the media as uncredited.

The transmitter **308** of the illustrated example transmits the credited media monitoring data to a central facility (e.g., the central facility **120** of FIG. **1**) for further processing. In some examples, where the example media creditor **306** does not discard the uncredited media monitoring data, the example transmitter **308** transmits the credited media monitoring data and the uncredited media monitoring data to the central facility **120** for further processing.

While an example manner of implementing the spillover manager **102** of FIG. **1** is illustrated in FIG. **3**A, one or more of the elements, processes and/or devices illustrated in FIG. **3**A may be combined, divided, re-arranged, omitted, eliminated and/or implemented in any other way. Further, the example frequency spectrum comparator **302**, the example frequency spectrum database **304**, the example media creditor **306**, the example transmitter **308**, and/or, more generally, the example spillover manager **102** of FIG. **1** may be implemented by hardware, software, firmware and/or any combination of hardware, software and/or firmware. Thus, for example, any of the example frequency spectrum comparator **302**, the example frequency spectrum database **304**, the example media creditor **306**, the example transmitter **308**, and/or, more generally, the example spillover manager **102** could be implemented by one or more circuit(s), programmable processor(s), application specific integrated circuit(s) (ASIC(s)), programmable logic device(s) (PLD(s)) and/or field programmable logic device(s) (FPLD(s)), etc. When reading any of the apparatus or system claims of this patent to cover a purely software and/or firmware implementation, at least one of the example frequency spectrum comparator **302**, the example frequency spectrum database **304**, the example media creditor **306**, the example transmitter **308**, and/or the example spillover manager **102** are hereby expressly defined to include a tangible computer readable storage device or storage disc such as a memory, DVD, CD, Blu-ray, etc. storing the software and/or firmware. Further still, the example spillover manager **102** of FIG. **1** may include one or more elements, processes and/or devices in addition to, or instead of, those illustrated in FIG. **3**A, and/or may include more than one of any or all of the illustrated elements, processes and devices.

Flowcharts representative of example machine readable instructions for implementing the media identifying meter **106**, **112** of FIGS. **1** and **2** and the spillover manager **102** of FIGS. **1** and **3** are shown in FIGS. **4**, **5**, and **6**. In this example, the machine readable instructions comprise a program for execution by a processor such as the processor **712** shown in the example processor platform **700** discussed below in connection with FIG. **7**. The program may be embodied in software stored on a tangible computer readable storage medium such as a CD-ROM, a floppy disk, a hard drive, a digital versatile disk (DVD), a Blu-ray disk, or a memory associated with the processor **712**, but the entire program and/or parts thereof could alternatively be executed by a device other than the processor **712** and/or embodied in firmware or dedicated hardware. Further, although the example program is described with reference to the flowcharts illustrated in FIGS. **4**, **5**, and **6**, many other methods of implementing the example media identifying meter **106**, **112** and the example spillover manager **102** may alternatively be used. For example, the order of execution of the blocks may be changed, and/or some of the blocks described may be changed, eliminated, or combined.

As mentioned above, the example processes of FIGS. **4**, **5**, and **6** may be implemented using coded instructions (e.g., computer and/or machine readable instructions) stored on a tangible computer readable storage medium such as a hard disk drive, a flash memory, a read-only memory (ROM), a compact disk (CD), a digital versatile disk (DVD), a cache, a random-access memory (RAM) and/or any other storage device or storage disk in which information is stored for any duration (e.g., for extended time periods, permanently, for brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term tangible computer readable storage medium is expressly defined to include any type of computer readable storage device and/or storage disk and to exclude propagating signals. As used herein, "tangible computer readable storage medium" and "tangible machine readable storage medium" are used interchangeably. Additionally or alternatively, the example processes of FIGS. **4**, **5**, and **6** may be implemented using coded instructions (e.g., computer and/or machine readable instructions) stored on a non-transitory computer and/or machine readable medium such as a hard disk drive, a flash memory, a read-only memory, a compact disk, a digital versatile disk, a cache, a random-access memory and/or any other storage device or storage disk in which information is stored for any duration (e.g., for extended time periods, permanently, for brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term non-transitory computer readable medium is expressly defined to include any type of computer readable device or disc and to exclude propagating signals. As used herein, when the phrase "at least" is used as the transition term in a preamble of a claim, it is open-ended in the same manner as the term "comprising" is open ended.

FIG. **4** is a flow diagram representative of example machine readable instructions that may be executed to implement the example spillover manager **102** of FIG. **1** to manage audio spillover in the example system **100** of FIG. **1**. The spillover manager **102** of the illustrated example is used to manage spillover to reduce (e.g., prevent) media monitoring inaccuracies in the system **100**.

The example spillover manager **102** determines if media monitoring data has been received (block **402**). The example spillover manager **102** is to receive media monitoring data from one or more media identifying meter(s) (e.g., the first and/or second media identifying meters **106**, **112** of FIG. **1**). The media monitoring data is representative of media that has been presented on one or more media presentation device(s) (e.g., the first and/or second media presentation devices **108**, **114** of FIG. **1**). Control remains at block **402** until media monitoring data is received by the example spillover manager **102**).

The example spillover manager **102** of the illustrated example analyzes the media monitoring data to determine if spillover has occurred (block **404**). An example method to determine if spillover has occurred is described below with reference to FIG. **6**. If the example spillover manager **102** detects spillover associated with the first and/or second media identifying meters **106**, **112** based on the media monitoring data, the media identified in the media monitoring data is not credited as an actual media exposure (block **406**) and the media monitoring data associated with the uncredited media is discarded (block **408**). Control then returns to block **402**. In some examples, rather than discarding the uncredited media monitoring data, the example spillover manager **102** identi-

fies the media monitoring data as uncredited media and exports the uncredited media monitoring data to a central facility (e.g., the example central facility **120**).

If the example spillover manager **102** of the illustrated example does not detect spillover associated with the first and/or the second media identifying meter **106**, **112**, the media identified in the media monitoring data is credited as an actual media exposure (block **410**). The example spillover manager **102** of the illustrated example exports media monitoring data associated with credited media to the example central facility **120** (block **412**). Control then returns to block **402** when the instructions are complete.

FIG. **5** is a flow diagram representative of example machine readable instructions that may be executed to implement the example media identifying meter **106**, **112** of FIG. **1** to collect media monitoring data and to determine frequency spectrums. In the illustrated example, to collect media monitoring data, the media identifying meter **106**, **112** extracts and/or analyzes codes and/or signatures from data and/or signals received from one or more media presentation devices (e.g., the first and/or the second media presentation devices **108**, **114** of FIG. **1**).

Initially, the example input **202** obtains a signal (e.g., an audio signal) from the one or more media presentation devices (e.g., the first and/or the second media presentation devices **108**, **114**) (block **502**). The example control logic **208** determines whether to collect a code or generate a signature from the signal obtained at the input **202** (block **504**). In the illustrated example, either a code is collected or a signature is generated from the signal. In other examples, both a code and a signature are collected and/or generated.

If a code is to be collected, the example code collector **204** collects a code from the signal obtained at the input **202** (block **506**). The example code collector **204** passes the collected code(s) to the timestamper **210**. If a signature is to be generated, the signature generator **206** generates a signature from the signal obtained at the input **202** (block **508**). The example signature generator **206** passes the generated signature(s) to the timestamper **210**.

The example frequency spectrum analyzer **216** of the illustrated example determines a frequency spectrum of the signal obtained at the input **202** (block **510**). The example frequency spectrum analyzer **216** passes the actual frequency spectrum and/or data representative thereof to the example timestamper **210**. The example timestamper **210** timestamps the collected codes and/or generated signatures and the actual frequency spectrums (and/or data representative thereof) (block **512**). The example timestamper **210** passes the collected codes and/or generated signatures and the actual frequency spectrums (and/or data representative thereof) to the example database **212**. The example database **212** stores the collected codes and/or generated signatures and the actual frequency spectrums (and/or data representative thereof) (block **514**). The example transmitter **214** periodically and/or aperiodically transmits the collected codes and/or generated signatures and the actual frequency spectrums (and/or data representative thereof) to the spillover manager **102** of FIG. **1**. Control then returns to block **502**. In some examples, the media identifying meter **106**, **112** collects and timestamps the collected audio data, and periodically or aperiodically exports the timestamped data for analysis by the spillover manager **102** (which may be located at the panelist site or at the central facility). In such examples, blocks **504**-**510** and **514** are not performed in the media identifying meter **106**, **112**, and blocks **512** and **516** are modified to operate on the received signal (as opposed to on codes, signatures, and/or frequency spectrums).

FIG. **6** is a flow diagram representative of example machine readable instructions that may be executed to implement the example spillover manager **102** of FIG. **3**A to manage audio spillover in the example system **100** of FIG. **1** by analyzing signal distortion based on frequency spectrums. The spillover manager **102** of the illustrated example is used to manage spillover to reduce media monitoring inaccuracies in the system **100**.

The example spillover manager **102** receives media monitoring data and actual frequency spectrums (and/or data representative thereof) from one or more media identifying meter(s) (e.g., the first and/or second media identifying meters **106**, **112** of FIG. **1**) (block **602**). The example spillover manager **102** uses the media monitoring data and actual frequency spectrums (and/or data representative thereof) to determine whether spillover occurred (e.g., in the example system **100** of FIG. **1**) and whether media is to be credited with an actual media exposure event.

The example frequency spectrum comparator **302** uses the example frequency spectrum database **304** to identify media (e.g., media that was presented at the first and/or the second media presentation device **108**, **114**) associated with the media monitoring data (block **604**) and to identify an expected frequency spectrum associated with the identified media (block **606**). Particular media programs are identified in the example frequency spectrum database **304** using the media monitoring data (e.g., using codes and/or signatures associated with the media). The example frequency spectrum database **304** stores media identifiers (e.g., identifiers of different media programs) along with expected frequency spectrums associated with the media.

The example frequency spectrum comparator **302** compares the expected frequency spectrum to the actual frequency spectrum (e.g., the actual frequency spectrum received from the first and/or the second media identifying meter **106**, **112**) to determine if signal distortion occurred (block **608**). The example frequency spectrum comparator **302** determines that signal distortion did occur if the actual frequency spectrum is not sufficiently similar to the expected frequency spectrum. The example frequency spectrum comparator **302** determines that signal distortion did not occur if the actual frequency spectrum is sufficiently similar to the expected frequency spectrum. In some examples, the frequency spectrum comparator **302** determines that the signal was distorted when the actual frequency spectrum was altered by more than a threshold amount when compared with the expected frequency spectrum. In some examples, the frequency spectrum comparator **302** determines that the signal was distorted when the actual frequency spectrum includes fewer high frequency elements than the expected frequency spectrum. In some examples, the frequency spectrum comparator **302** determines that the signal was distorted when the actual frequency spectrum includes fewer mid-frequency elements than the expected frequency spectrum.

In some examples, to determine if signal distortion occurred, the example frequency spectrum comparator **302** calculates a summation of the absolute values of the differences between amplitudes of corresponding frequency components of the actual frequency spectrum and the expected frequency spectrum. In such examples, the example frequency spectrum comparator **302** compares the summation of the absolute values of the differences between the amplitudes to a threshold. If the summation of the absolute values of the differences between the amplitudes is larger than the threshold, the example frequency spectrum comparator **302** determines that signal distortion did occur and, thus, the collected media data is due to spillover. If the summation of the abso-

lute values of the differences between the amplitudes is not larger than the threshold, the example frequency spectrum comparator **302** determines that signal distortion did not occur and, thus, the collected media data is valid (i.e., not due to spillover).

If the actual frequency spectrum is not sufficiently similar to the expected frequency spectrum (e.g., if signal distortion did occur) (block **608**), the example frequency spectrum comparator **302** determines that spillover did occur and instructs the example media creditor **306** not to credit the media as an actual media exposure (block **610**). If the example frequency spectrum comparator **302** determines that spillover did occur, the example media creditor **306** discards the media monitoring data associated with the media (block **612**). Control then returns to block **602**. In some examples, rather than discarding the media monitoring data associated with the media that is not credited, the example media creditor **306** marks the media monitoring data associated with the media as uncredited.

If the actual frequency spectrum is similar to the expected frequency spectrum (e.g., signal distortion did not occur) (block **608**), the example frequency spectrum comparator **302** determines spillover did not occur and the example media creditor **306** credits the media as an actual media exposure (block **614**). In particular, the example media creditor **306** marks the media monitoring data associated with the media as credited (block **614**). The example transmitter **308** transmits the credited media monitoring data to a central facility (e.g., the central facility **120** of FIG. **1**) for further processing (block **616**). In some examples, where the example media creditor **306** does not discard the uncredited media monitoring data, the example transmitter **308** transmits the credited media monitoring data and the uncredited media monitoring data to the central facility **120** for further processing (block **616**). Control then returns to block **602** when the instructions are complete.

The credited media monitoring data is combined with the people meter data using timestamps to align the two data sources to match demographics and audience size data to the credited media exposures.

FIG. **7** is a block diagram of an example processor platform **700** capable of executing the instructions of FIGS. **4**, **5**, and **6** to implement the media identifying meter **106**, **112** of FIGS. **1** and **2** and the spillover manager **102** of FIGS. **1** and **3**. The processor platform **700** can be, for example, a server, a personal computer, a mobile device (e.g., a cell phone, a smart phone, a tablet such as an iPad™), a personal digital assistant (PDA), an Internet appliance, a DVD player, a CD player, a digital video recorder, a Blu-ray player, a gaming console, a personal video recorder, a set top box, or any other type of computing device.

The processor platform **700** of the illustrated example includes a processor **712**. The processor **712** of the illustrated example is hardware. For example, the processor **712** can be implemented by one or more integrated circuits, logic circuits, microprocessors or controllers from any desired family or manufacturer.

The processor **712** of the illustrated example includes a local memory **713** (e.g., a cache). The processor **712** of the illustrated example is in communication with a main memory including a volatile memory **714** and a non-volatile memory **716** via a bus **718**. The volatile memory **714** may be implemented by Synchronous Dynamic Random Access Memory (SDRAM), Dynamic Random Access Memory (DRAM), RAMBUS Dynamic Random Access Memory (RDRAM) and/or any other type of random access memory device. The non-volatile memory **716** may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory **714**, **716** is controlled by a memory controller.

The processor platform **700** of the illustrated example also includes an interface circuit **720**. The interface circuit **720** may be implemented by any type of interface standard, such as an Ethernet interface, a universal serial bus (USB), and/or a PCI express interface.

In the illustrated example, one or more input devices **722** are connected to the interface circuit **720**. The input device(s) **722** permit a user to enter data and commands into the processor **712**. The input device(s) can be implemented by, for example, an audio sensor, a microphone, a camera (still or video), a keyboard, a button, a mouse, a touchscreen, a trackpad, a trackball, isopoint and/or a voice recognition system.

One or more output devices **724** are also connected to the interface circuit **720** of the illustrated example. The output devices **724** can be implemented, for example, by display devices (e.g., a light emitting diode (LED), an organic light emitting diode (OLED), a liquid crystal display, a cathode ray tube display (CRT), a touchscreen, a tactile output device, a light emitting diode (LED), a printer and/or speakers). The interface circuit **720** of the illustrated example, thus, typically includes a graphics driver card.

The interface circuit **720** of the illustrated example also includes a communication device such as a transmitter, a receiver, a transceiver, a modem and/or network interface card to facilitate exchange of data with external machines (e.g., computing devices of any kind) via a network **726** (e.g., an Ethernet connection, a digital subscriber line (DSL), a telephone line, coaxial cable, a cellular telephone system, etc.).

The processor platform **700** of the illustrated example also includes one or more mass storage devices **728** for storing software and/or data. Examples of such mass storage devices **728** include floppy disk drives, hard drive disks, compact disk drives, Blu-ray disk drives, RAID systems, and digital versatile disk (DVD) drives.

The coded instructions **732** of FIGS. **4**, **5**, and **6** may be stored in the mass storage device **728**, in the volatile memory **714**, in the non-volatile memory **716**, and/or on a removable tangible computer readable storage medium such as a CD or DVD.

Although certain example methods, apparatus and articles of manufacture have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the claims of this patent.

What is claimed is:

1. A method to credit media presented by a media presentation device, the method comprising:

determining, via a processor, an actual frequency spectrum of the media monitored by a meter;

determining, via the processor, absolute values of differences between amplitudes of corresponding frequency components of the actual frequency spectrum and an expected frequency spectrum, the expected frequency spectrum stored in a database in association with a media identifier corresponding to the media;

determining, via the processor, whether spillover occurred based on a summation of the absolute values satisfying a threshold; and

crediting, via the processor, the media with a media exposure if spillover did not occur.

2. The method as defined in claim **1**, wherein the meter is a portable people meter to be worn or carried by a panelist.

3. The method as defined in claim 1, wherein the actual frequency spectrum is based on a sample of the media presented by the media presentation device and collected by the meter.

4. The method as defined in claim 3, further including discarding, via the processor, the sample of the media corresponding to the actual frequency spectrum if spillover did occur.

5. The method as defined in claim 3, further including;

determining, via the processor, whether the actual frequency spectrum represents a sound not associated with the media; and

when the actual frequency spectrum represents the sound not associated with the media, discarding, via the processor, the sample of the media corresponding to the actual frequency spectrum before determining the absolute values of the differences between the amplitudes of the corresponding frequency components of the actual frequency spectrum and the expected frequency spectrum.

6. The method as defined in claim 1, wherein the expected frequency spectrum is calculated prior to determining the actual frequency spectrum of the media.

7. The method as defined in claim 1, wherein the determining that spillover occurred indicates that the meter is in a different room from the media presentation device.

8. An apparatus to credit media presented by a media presentation device, the apparatus comprising:

a frequency spectrum analyzer to determine an actual frequency spectrum of the media monitored by a meter;

a frequency spectrum comparator to:

determine absolute values of differences between amplitudes of corresponding frequency components of the actual frequency spectrum and an expected frequency spectrum, the expected frequency spectrum stored in a database in association with a media identifier corresponding to the media;

determine whether spillover occurred based on a summation of the absolute values satisfying a threshold; and

a media creditor to:

credit the media with a media exposure if spillover did not occur; and

not credit the media with the media exposure if spillover did occur.

9. The apparatus as defined in claim 8, wherein the meter is a portable people meter to be worn or carried by a panelist.

10. The apparatus as defined in claim 8, wherein the actual frequency spectrum is based on a sample of the media presented by the media presentation device and collected by the meter.

11. The apparatus as defined in claim 10, wherein the media creditor is further to discard the sample of the media corresponding to the actual frequency spectrum if spillover did occur.

12. The apparatus as defined in claim 10, wherein the frequency spectrum analyzer is further to:

determine whether the actual frequency spectrum represents a sound not associated with the media; and

when the actual frequency spectrum represents the sound not associated with the media, discard the sample of the media corresponding to the actual frequency.

13. The apparatus as defined in claim 8, wherein the expected frequency spectrum is calculated prior to determining the actual frequency spectrum of the media.

14. The apparatus as defined in claim 8, wherein determining that spillover occurred indicates that the meter is in a different room from the media presentation device.

15. A tangible computer readable storage medium comprising instructions that, when executed, cause a computing device to:

determine an actual frequency spectrum of the media monitored by a meter;

determine absolute values of differences between amplitudes of corresponding frequency components of the actual frequency spectrum and an expected frequency spectrum, the expected frequency spectrum stored in a database in association with a media identifier corresponding to the media;

determine whether spillover occurred based on a summation of the absolute values satisfying a threshold; and

credit the media with a media exposure if spillover did not occur.

16. The tangible computer readable storage medium as defined in claim 15, wherein the meter is a portable people meter to be worn or carried by a panelist.

17. The tangible computer readable storage medium as defined in claim 15, wherein the actual frequency spectrum is based on a sample of the media presented by the media presentation device and collected by the meter.

18. The tangible computer readable storage medium as defined in claim 17, further including instructions that, when executed, cause the computing device to discard the sample of the media corresponding to the actual frequency spectrum if spillover did occur.

19. The tangible computer readable storage medium as defined in claim 15, wherein the expected frequency spectrum is calculated prior to determining the actual frequency spectrum of the media.

20. The tangible computer readable storage medium as defined in claim 15, wherein determining that spillover occurred indicates that the meter is in a different room from the media presentation device.

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